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USSR Report

ENERGY

No. 13

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FUELS

FUELS

SYSTEM FOR CALCULATING LONG-RANGE OIL-INDUSTRY PLANS DEVISED

Moscow NEFTYANIK in Russian No 11, Nov 79 pp 26-29

[Article by M. Sattarov, doctor of engineering sciences and professor, of VNIIOENG [All-Union Scientific-Research Institute for Organization of the Management and Economics of the Oil and Gas Industries]: "A System for Design and Planning Calculations in the Oil Industry"]

[Text] Planning is the central element--the heart--of guidance of the national economy under socialism. The development and successful execution of five-year plans are indisputable testimony to that. However, recently it has become necessary to lengthen the period covered by planning, because of the sharp increase in the scale of production in the era of developed socialism, and the acceleration of scientific and technical progress and the rise of its role in the economy's progress. Long-term plans are revised after the expiration of each five-year plan and recomputations are made to include the next five years. In accordance with decisions of the 24th and 25th CPSU congresses, long-term plans are made up for a 15-25 year period. They are improved continuously, enriched by the achievements of economic science and planning theory and experience. The CPSU Central Committee and USSR Council of Ministers decree, "Improvement of Planning and Strengthening of the Effect of the Management Mechanism on Raising Production Effectiveness and Work Quality," calls for further measures to raise the level of planning work in the national economy.

In the petroleum-producing industry, five-year and long-term planning has a number of features that distinguish it from other industries, including the extractive industries, which are caused by the following:

--the product of the oil-producing industry is the starting raw material for many branches of the national economy;

--modern oil-producing, refining and petrochemical complexes are erected over a period of 5-10 years or more, and after introduction into operation they must have raw materials for more than 15 years of normal functioning; this requires the forecasting of oil production for at least a 20-25 year period;

--long-term plans call for a certain portion of the production to come from fields that have not been discovered yet--the longer the period covered by the planning the greater the share that is to come from undiscovered oilfields, so long-terms plans for oil recovery acquire a probabilistic nature, and deviations from it in one direction or another are inevitable;

--the share of oil reserves in total mineral-fuel resources is not great (in world estimates of recoverable fuel reserves, coal and peat make up about 90 percent, while the share for gas and oil is no more than 10 percent), yet oil is also a most valuable feedstock for the chemical industry and still is an irreplaceable source for the production of motor fuels and oils, diverse products are produced from it, and the utilization effectiveness of oil continues to grow from year to year; and

--despite the fact that the oil-producing industry is a single-product branch, that is, its final product is base oil, it is in its internal structure a complicated system: it consists of a large number of fields, deposits and individual facilities for development that are spread over a vast territory, and the fields themselves are distinguished by diversity of geological-operating conditions and natural and climatic conditions, and also by the status of the producibility of the reserves.

The characteristics of the oil industry's basic product--crude oil--require that potential levels of recovery be coordinated with plans for developing the fuel and energy complex as a whole. The main task of this complex is to satisfy the national economy's energy requirements at maximum expense. In considering that the national economy's total energy requirement is the business of all fuel-extracting industries taken together (coal, petroleum and gas), and also of hydroelectric power, nuclear energy and all the branches of power engineering that will appear in the future as a result of scientific and technical progress, it is necessary, when planning the country's fuel and power balance, to save oil. The necessity for saving oil ensues from the fact that it is not only a power-engineering raw material with a broad spectrum of applicability, but it is also a feedstock for obtaining petrochemical products. Special attention was paid to this at the 25th CPSU Congress. In the Accountability Report to the congress, General Secretary of the CPSU Central Committee Comrade L. I. Brezhnev pointed out that "...an increase in the production of base oil will matter little if a substantial part of it is burned in the form of mazut instead of being used to obtain more valuable types of fuel and petrochemicals and to increase the export potential." This instruction is being implemented by the establishment of priorities in meeting the national economy's requirements for oil refining: the petrochemical industry is first priority, the country's motor-vehicle fleet is second, and the fuel-and-power complex is next in line.

The priority for satisfying requirements that was adopted is explained by the great effectiveness in using crude oil as a unique chemical feedstock, the impossibility of replacing petroleum as a source of motor fuel and lubricants in the current period without a technical revolution in

motor-vehicle manufacturing, and, at the same time, the relative lack of complication in replacing petroleum by other types of fuel for use in boilers and furnaces.

Within the unified fuel and power complex, the petroleum complex includes the preparation of reserves and the recovery and refining of the crude oil. These three component parts of it should be developed strictly in balance, that is, it is necessary that geological exploration be conducted in time in order to pave the way for increasing oil recovery by the required amounts, introducing fields into development in optimal sequence, to provide for the appropriate degree of refining of the oil recovered, and to satisfy more completely the country's requirements for petroleum products.

The oil-production industry occupies the central place in the petroleum complex, so the compilation of sound, scientifically substantiated plans for developing it becomes of the greatest importance. And planning effectiveness and the practical worth of plan indicators depend primarily upon precision in computing oil recovery levels for individual deposits, fields and groups of fields.

Computations for determining the oil-recovery level, aside from five-year and long-term planning, are made when drawing up designs for developing oilfields and for evaluating the effectiveness of new reservoir-stimulation methods and new technology for recovering oil, when compiling technical and economic reports, and so on. A great amount of the scientific research and planning that is associated with determining the outlook for progress in oil recovery is being done for the industry as a whole. Highly qualified specialists in the industry's scientific-research, design and production organizations are doing this work. But the effectiveness of their work and the reliability of the plans prepared are reduced substantially because of the lack of a unified structure of technical and economic indicators and of methods for determining them. As a result, design and planning documentation presented by Minnefteprom [Ministry of Petroleum Industry] for the approval by various sections of USSR Gosplan, USSR Gosstroy and the USSR State Committee on Science and Technology, as well as by AN SSSR [USSR Academy of Sciences] institutes and organizations of related branches of industry, for use in interindustry economic planning computations, is not always adequately harmonious and sometimes it is contradictory. This leads to numerous recalculations, duplication in the work of scientific-research, design and production organizations, and the repeated gathering of the very same baseline data.

With a view to surmounting the deficiencies noted, the Ministry of Petroleum Industry has adopted a decision to make designs and flow charts for development purposes the basis for planning oil recovery. These design documents should be refined every 5 years, before the next five-year plan is prepared.

The plan level for oil recovery should be calculated in the designs for developments in accordance with the formula

$$Q_t = Q^c_{t-1} \cdot K_t + Q^H_t,$$

where Q_t is the recovery of oil in the planned year;

Q^c_{t-1} is the recovery of oil from all wells in the year preceding planned year;

K_t is the coefficient of change in recovery; and

Q^H_t is the recovery of oil from wells that will be drilled during the planned year.

Introduction of the coefficient of change of recovery K_t is predicated on the fact that oil production for a given group of wells does not remain constant with time, but changes, being reduced as a rule. The drop in oil recovery during the planned year at the wells that are carried over from the preceding year occurs for various reasons.

When operating a field with natural reservoir drive, it occurs as a consequence of drop in reservoir pressure.

In developing oilfields with reservoir-pressure maintenance, the recovery-change coefficient is a function of a large number of factors, and it changes in time in accordance with a rather complicated law. The drop in output is provoked here primarily by a consistent increase in water encroachment of the product being recovered. Moreover, neither do well flows remain constant for the liquid. In the initial stage of a field's development, when the water-flooding system has not been completely mastered yet, this occurs because of a reduction in reservoir pressure. Drop in well flows also occurs because of silt deposition of the bottomhole area, a deterioration in flow conditions after the appearance of water, the drilling over of poorly productive sections of a field, and so on. But there are factors that promote an increase in well productivity. These are an increase in reservoir pressure through intensification of the water-flooding system, the use of various methods for intensifying the influx to the well bottoms, the replacement of underground equipment by more productive equipment, and other factors. As a result of the combined influence of the enumerated parameters, the coefficient of recovery change for the carryover inventory can in some years be greater than unity because of fluctuations in well flows.

A drop in recovery of the carryover well inventory also occurs because of a contraction of the oil zone's outline, as a result of which wells are shut off and the operating-well inventory is decreased.

The growth of water encroachment of the product being recovered, changes in time in well flow of the liquid, and reduction of the operating inventory are the basic causes of change in oil recovery at carryover wells. The dynamics of change of these parameters can be determined by the calculation

method when designs and flow charts for development are being prepared. Moreover, their values for the long term can be established by hydrodynamic methods of calculation, using modern digital and analog computers, which are highly accurate. Having the oil-recovery levels and technical and economic indicators for the long term for all fields being developed, and also for all fields that will be put into operation during the planned period, it is easy to compute the potential for each oil-producing association and then also for the industry as a whole. However, this should not be simple addition, since the fields have different productivities, and different material and labor resources expenditures will be required to recover the very same amount of crude. Consequently, the optimal sum must be found. This means that those options for developing the various fields and that sequence for introducing them into operation must be chosen that will provide the necessary total levels of oil recovery for the association or the industry as a whole at minimal expense and with as high a withdrawal of crude from the reservoirs as possible. In this case it should be borne in mind that minimization of expenses must be achieved not for brief periods but over long time intervals, which are counted in several five-year periods. It is easy to show that short-term and long-term minimization of expenditures are not the same. For example, in order to carry out the current annual plan at minimal expense, well drilling should be concentrated at highly productive sections of the fields by increasing the density of the well network. However, this measure will later lead to a rapid drop in recovery at these sections and the short-term use here of structures built for prolonged use, and it will necessitate speeding up the introduction of other fields into operation. This approach will lead, in the final analysis, to the irrational use of resources. It is another matter when a field's development is optimized for the long term, covering 15 years or more. In this case, timely decisions are made that provide for lengthy and stable oil recovery.

One of the most important tasks of long-term planning is the forecasting of scientific and technical progress (NTP) and the wide introduction of its achievements into production operations. The formula cited above will enable the system-programing method to be used for planning NTP in all oil-production subbranches. For these purposes the component parts of recovery that enter into it are examined in greater detail. Thus, oil recovery levels for the carryover fund Q^{c}_{t-1} are determined by multiplying the average flow per carryover well, the number of wells in the operating inventory, the inventory's utilization factor, the oil content of the liquid recovered, and the coefficient of operation of the wells. The recovery of crude from new wells introduced into operation during the planning year Q^{H}_{t} is found as the product of the flow of the new wells, their number and the number of days of operation. It is especially important to emphasize that each of the enumerated parameters is amenable to control. The over-all level of oil recovery can be changed by acting on them.

Thus, liquid flow of the carryover wells can be increased by intensifying the influx to the bottom hole. Many such methods are known at this time,

and they are used in all oil-producing regions, providing dditional oil recovery. It can be achieved by improving the equipment and technology of well operation. The coefficients of well-inventory utilization and of oil content in the product recovered are influenced by the use of appropriate methods in overhauling wells--for example, by correcting poor-quality plugging and by insulating water influxes. The values of the operating factor can be increased considerably by timely and high-quality conduct of underground repair, as well as by raising equipment reliability and, consequently, reducing the number of repairs.

The flow of new wells and the number of them also are controllable values. Methods have now been worked out to drill into beds that permit the permeability of the bottom hole zone not to be reduced. Introducing them widely will allow the flow of new wells to be increased. By increasing drilling speed and by reducing the time taken to complete wells that have been drilled, both their number and the number of operating days are increased.

Of great interest from the point of view of planning scientific and technical progress is control of the value of the coefficient that considers the change in recovery of oil from carryover wells. This can be done by reducing the coefficients of drop in recovery by drawing oil reserves into active development by the use of various stimulation methods, including new ones, that raise the final withdrawal of crude.

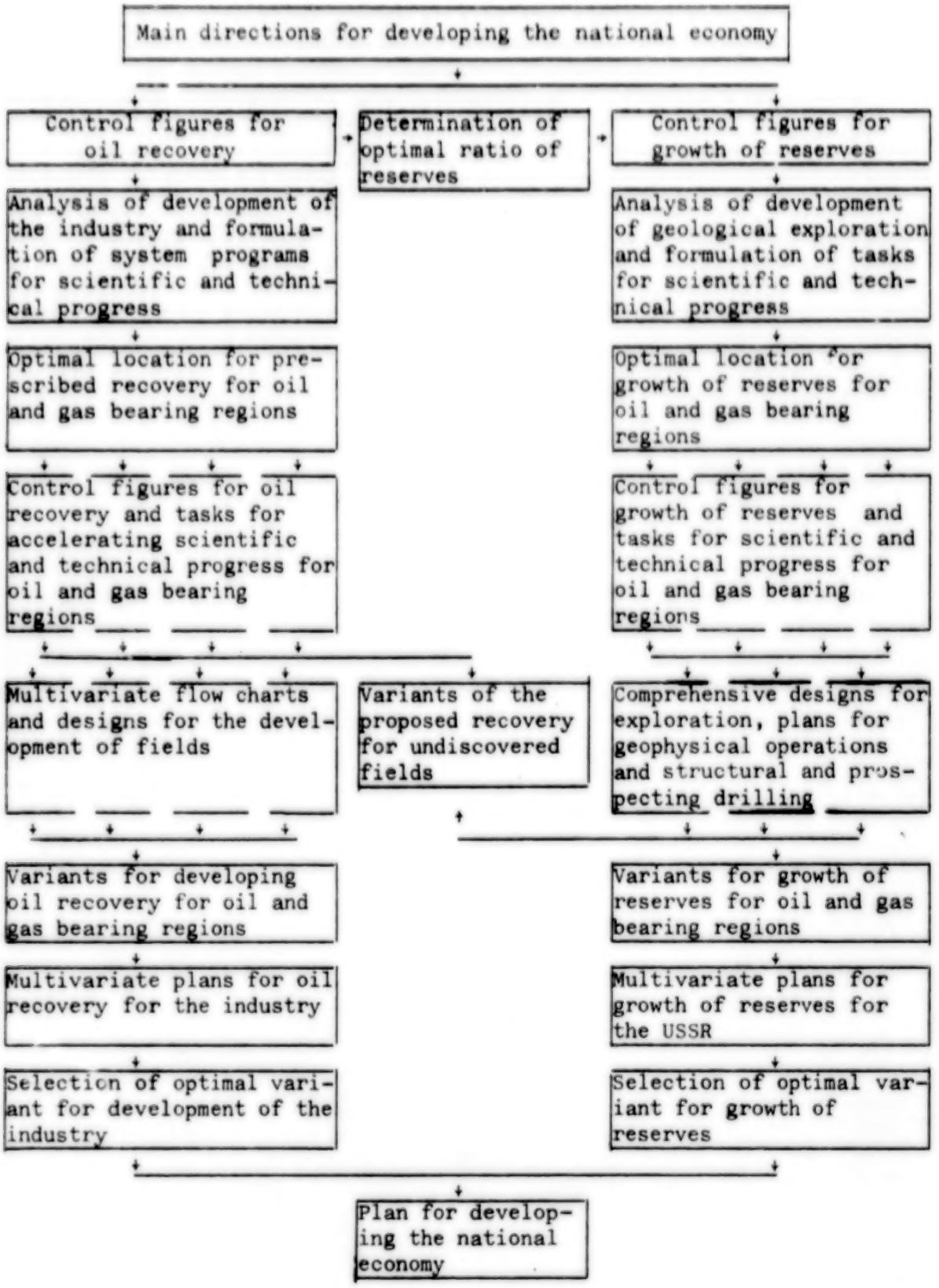
Thus it is possible to clarify the degree of influence of each parameter, one after another, on the oil recovery level, that is, on the final goal of the industry--to choose those measures and those areas of NTP that will yield the greatest growth in oil recovery. And, what is still very important, since both the long-term planning of oil recovery and the planning of scientific and technical progress are performed on the basis of the very same formula, is that organic unity be achieved by them.

These are the methodological bases of design and planning calculations that are now being performed in the oil industry. How does the planning process occur in practice? It is divided fairly precisely into two stages: preplan analysis, and the planning itself.

At the preplan analysis stage, USSR Gosplan determines the country's requirements for oil product, taking into consideration the requirements for developing the fuel-and-power balance and export volume. The Ministry of Petroleum Industry, for its part, determines possible levels of oil recovery, taking into consideration the actual status of the oil-producing regions, the prospects for growth of reserves, the drilling in of new oil and gas producing provinces and introduction of the achievements of scientific and technical progress. On the basis of repeated information exchange, USSR Gosplan and Minnefteprom establish control figures for oil recovery for the planned period. At this stage, preplan analysis is completed.

Development of the plan after the control figures have been obtained is accomplished in this order.

SCHEME FOR DESIGN AND PLANNING CALCULATIONS



Based upon the oil-recovery levels indicated in the control figures, an optimum reserve factor is determined and the task for growth of industrial-category oil reserves is set. Then oil recovery and growth in reserves are planned under a single scheme.

Let us examine first the sequence for designating locations for oil recovery.

The Ministry of Petroleum Industry distributes the oil-recovery levels assigned to the industry as a whole among the oil and gas producing regions and establishes control figures for oil recovery for each region. Simultaneously, based upon an analysis of the industry's development and a determination of the bottlenecks in its activity, system programs for scientific and technical progress are formulated. Depending upon the actual status of the activity and the prospects for growth of raw-material resources in various regions, several development variants that cover the potential oil-recovery levels between the upper and lower limits are given.

The oil and gas producing regions develop the plan in detail, based upon the control figures received for oil recovery and growth of reserves and upon tasks for speeding up scientific and technical progress. For these purposes, precise multivariate flow charts and designs for development are compiled for the fields that are being developed or are to be prepared for development. The proposed levels of oil recovery for the group of deposits that have not been drilled into are fixed in accordance with variants for growth in reserves during the plan period. For each prescribed level of oil recovery, an optimal set of fields and corresponding variants for their development, which call for the priority introduction into operation of high-flow, economically effective targets for development, is set.

Optimal variants of the plan for developing an oil producing region that have been obtained on the basis of detailed analysis, along with plans for speeding up scientific and technical progress, are presented to Minnefteprom for refinement of the priority location of recovery by region. If the results of the detailed analysis deviate from the original control figures for any particular region, repeat calculations are made for the same scheme.

Based on the papers presented, a multivariate plan for oil recovery for the industry as a whole is prepared. Then, based upon an analysis of development of the oil complex and optimization of the country's fuel and power balance, a rational variant for development of the oil industry is chosen, which becomes a component part of the plan for developing the national economy.

A similar sequence of calculations is adhered to also when planning growth of reserves. The Ministry of Petroleum Industry, jointly with USSR Ministry of Geology, establishes control figures for the plan for preparing industrial-category reserves for the oil and gas bearing districts. The organizations that do the prospecting and exploration in the field prepare

detailed plans in accordance with the data of comprehensive designs for searching, prospecting and structural drilling, and geophysical research. After refinement, based upon a mutual exchange of information for each oil and gas bearing district, optimized plans for growth in reserves are established.

The scheme for design and planning calculations that has been presented is fully realized under long-term planning. In these plans, which are subject to refinement every 5 years, the proposed oil recovery from undiscovered fields is considered, and the effect of scientific and technical progress in the area of equipment and technology in all subbranches of oil production is adopted in the computations. The technical and economic indicators for the long-term plan are computed according to consolidated standards.

Five-year planning is done in greater detail on the basis of industrial flow schemes and designs for development, the technical and economic indicators of which are refined before the start of each five-year period. In five-year plans oil recovery from undiscovered fields is not considered. The effect only of those factors of scientific and technical progress whose introduction into production operations has already started and of geological-engineering and organizational and technical measures that have been developed and are to be introduced during the plan period is considered.

As a whole, the system of design and planning calculations has a number of virtues, as experience in its use has indicated:

--it provides for high precision in calculating plan levels for oil recovery for the associations and the industry as a whole, because in summing up the indicators for the various facilities, errors are mutually canceling, in accordance with the law of large numbers;

--it provides organic unity for calculations of indicators for the long-range plan for developing the industry with plans for scientific and technical progress; and

--it permits the effectiveness of various areas of scientific and technical progress to be assessed by a single indicator--the rise in the level of oil recovery, that is, increase in the industry's final product.

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PROGRESS AND PROBLEMS IN FUEL PRODUCTION

Arctic Oil in Yamal

Moscow TRUD in Russian 5 Jan 80 p 1

[Article by S. Yurchenko, reporting from the village of Tadibeyakha on the Gydanskiy Peninsula: "Arctic Crude"]

[Text] Prospectors of the "Yamalneftegazgeologiya" association discovered in the arctic tundra of Gydanskiy Peninsula the Utrenneye oil and gas condensate field, the world's northernmost oil field. The first commercial flow of crude was achieved there recently. In 1980 geologists will do an exact assessment of the reserves of gas, gas condensate and black gold over much of the territory of that field.

There are two rows of home-built cabins, a modest administrative building, standing near the very lips of the Ob' River, and two large hangar-like warehouses. It is the settlement of Tadibeyakha, where 600 prospectors of the just-established Gydanskaya expedition of the "Yamalneftegazgeologiya" association settled a little more than a year ago. One must fly 750 km to the southeast to get to Salekhard, a city on the Arctic Circle.

In these months have arisen on the arctic tundra, where the ground is covered with a solid blanket of brown arctic moss and the azure blue of circular lakes in the summer, and by a unique snow desert in the winter, the steel foundations of drilling derricks, and winter shacks have spread out for hundreds of kilometers. A Morse code sings incessantly in a small room on the second floor of the only 2-story building to the entire neighbo.hood, transmitting reports about the progress of operations at the wells.

One of these reports, received from the first drilling rig of the Utrennaya site, briefly announced: "The world's northernmost commercial flow of crude has arrived!"

The drilling brigade of foreman N. Slyusar' took only 85 days, instead of the planned 115 days, to drill several thousand meters into the ground.

And there, after passing through several layers of gas and gas condensate, the geologists tapped a productive black gold formation.

Nobody closed his eyes at the drilling rig for days. They wanted to see how much oil would surface under the natural formation pressure. Then the chief of the geology department of the expedition, Yu. Surkov, in a characteristic gesture, stroked his mustache and announced: "The flow is commercial."

"... You reckless slobs," V. Singutskiy, the 30-year old chief engineer of the expedition, reprimanding two young drivers, was not angry about the prank. The two thought a while and undertook the next experiment. Taking advantage of the absence of the boss at the 25ist, they took and filled the tank of the all-terrain vehicle with raw crude. Then they cranked up the diesel and dashed across the tundra on it, making daring donut-shaped figures on it. Of course, the arbiters and trouble-shooters, after examining the exhaust pipe, confirmed that the resulting carbon deposits were the same as what solar oil would have produced. But the young fellows jeopardized the machine and, of course, their health. And the boss also reprimanded them for it. But their experiment confirmed once again the conclusion, made by specialists after primary chemical analysis: the Gydanskaya crude is of excellent quality.

Standing in the gusts of the penetrating arctic wind, it is hard to believe that a warm southern sea once occupied this land. But in the geologic time scale, where time is measured in tens of millions of years, and our entire Quaternary period with its glaciers and mammoths is only a wink of the eye, not only the climate, but also the outlines of Western Siberia change. These changes evidently occurred here more than once. And the discovery of oil is experimental confirmation of this theory. The black gold could have formed here only from organic fossils of a tropical sea.

"Our task now is to outline the boundaries of this basin," says the chief of "Yamalneftegazgeologiya," Lenin Prize laureate V. Podshibyakin. "We have to do that before we can assess the reserves of the crude discovered in the Utrenneye field. And in the future, if, of course, our primary estimates turn out to be correct, it may become a reliable fuel and energy base for one of the main arteries of our country -- the North Sea lane."

Kuzbass Coal

Moscow IZVESTIYA in Russian 25 Feb 80 p 3

[Article by M. Reshetnikov, mechanized brigade leader of the "Zyryanovskaya" mine, meritorious RSFSR miner: "The Mining Legions"]

[Text] Modern technology has made us, the miners, a truly gargantuan force. How long ago was it that the production of 200 or 300 tons of coal a day was considered a success? And now more than 200 brigades in the Kuzbass alone have a mean daily production of more than 1,000 tons. In the

completely mechanized longwalls the seam is broken up by combines, continuously-operating conveyor systems have been installed and the roof is supported with hydraulic props.

But we must not forget Vladimir Il'ich Lenin's words: "Communism means higher, compared with capitalism, labor productivity from voluntary, cognizant and united workers, equipped with advanced technology." Yes, potent technology in skilled hands can and must create excellence. The result of a worker's labor depends enormously on how he uses modern technology and on his knowledge, experience, skill and discipline.

In his address to the voters of the Baumanskiy electoral district of Moscow, Comrade Leonid Il'ich Brezhnev emphasized: "...If the people work courageously, take the initiative and embrace competent initiatives, success will be assured."

Take our brigade. We began the 5-year plan in the middle. In 1 year we produced a little more than 500,000 tons of coal. Then it was 600,000, and after that 745,000. And finally, this year, we passed the 1 million milestone.

Here, it is true, there is something to think about. The mine was the same as before, and the makeup of the brigade was basically the same. The geologic mining conditions have not changed significantly. The machinery is of the series production variety. What, then, enabled us to practically double production?

I would like to answer this question briefly as follows: the responsibility of each member of the brigade for the work assigned to him, for the machinery entrusted to him, increased sharply. The organization of labor was also improved, of course. The experience of the brigades of Hero of Socialist Labor V. Devyatko at the "Raspadskaya" mine and of V. Bardyshev at the Novokuznetskaya mine was of great help to us.

A visit to their cutting faces was a dramatic lesson that one cannot go into the world of modern technology with the baggage of obsolete knowledge. The motto "One for all and all for one" expresses the essence of collective responsibility for the results of labor. New technology, new organization of labor and new relations of people on the team, subordinated to the common task of the universal improvement of the effectiveness of production and quality of work, demand exactly that kind of responsibility.

Consider this example. The transfer of a brigade from one longwall to another has always involved downtime. Production losses are provided for this case, even in monthly plans. There is one solution -- work in such a way as to eliminate downtime.

At our mine the drilling brigades of I. Korotnev, A. Kitov and P. Donskiye are responsible for preparing the stripped longwall. Their monthly

assignments are based not on arbitrary standards, but on the specific requirements of the mechanized longwalls, which are consistent with their rates of work.

It must be said immediately that the efficient utilization of technology is inconceivable without good engineering support. Furthermore, the transportation system for hauling out the coal is excellently planned and the material supply service works efficiently.

Once the familiar brigade leader of the neighboring shaft, visiting our longwall, said that under such "hothouse" conditions he and his boys would also abandon the mine. I told him straight out that I strongly doubt that. There was no doubt about his skill or labor enthusiasm. But if he himself considers the mechanized longwall under normal conditions to be a hothouse, what can he expect from himself and from others? People determine the procedures at the mine.

And the main thing here, and let us not forget this, is to instill in each brigade member respect for his work and for the work of his comrades and responsibility for the powerful machinery with which he is entrusted.

That brigade leader was worried that his combiners would be changed frequently. We do have forced replacements, of course, but not frequently. One of the most experienced of our workers, D. Tokarev, is getting ready to retire. This is a great loss, of course. However, his protege, V. Brazhnikov, in whom he instilled the skill and devotion of the mining profession, will remain with us. Combine operator V. Surkov trained a worthy replacement in the person of Yu. Mashinskiy.

In a word, the training of good replacements for each of us is an important matter. And nobody is surprised, for example, to learn that three of my sons work with me in my brigade. Perhaps one of them will also become a brigade leader.

Young Sergeyev, Men'shov and Gusamov work side by side with their fathers. There is good continuity. These fellows can do anything, and they have been taught -- and taught by us, I emphasize -- to work all out, with ardor and imagination. They do not worry about problems that nature herself holds in store for the miner, and they are contemptuous of those who tolerate common lack of discipline.

I have a reason for talking so much about the spiritual, moral tempering of man. It, like purely industrial training, is of deciding importance today. The mining dynasties have been emerging for many years. And throughout all these years the uncle should serve for the nephew, and father for son, as an example of respect for his difficult profession, for devotion to duty.

New technology demands the highest labor discipline. For example, the cutter-shoveler who walks off the job, leaving a brigade that does not

prepare coal for blasting, costs a production loss of 15-20 tons. This obviously is not good, but it is even worse when a combine mechanic or fitter is not replaced at a mechanized longwall; that costs hundreds of tons. And that is why the strictest labor discipline, again based on a conscientious attitude on the part of the people toward their responsibilities, has long been the standard of the brigade. We have no quitters. We also have no laggards. We plan our scheduled vacations so that they do not coincide with the transfer of the brigade to a new longwall.

And is this true for just us? I witnessed how the brigade of Hero of Socialist Labor and member of the Presidium of the USSR Supreme Soviet, G. Smirnov, works. They use a different technique; the seam there is broken up with hydraulic giants and the coal is transported by water through pipelines. And there the attitude of the people toward their industrial responsibilities, their discipline and diligence, are maintained at the highest level.

Experienced miners know that no two longwalls are identical; the roofs behave differently, different kinds of faults and dislocations of the seams are encountered. This means that it is necessary to know how to adapt a series production model of a complex to specific geological conditions and to operate it at the maximum load.

At the "Nagornaya" mine the complexes are erected by I. Krasnov's brigade. The foremen are the most reliable people: they are not potboilers, and they do not put on airs to make themselves look good at the expense of others. But during final adjustment of the equipment stoping brigade leader, Hero of Socialist Labor Ye. Drozdetskiy, has to dispatch his authorized representatives to the fitters and find time on his own to inspect and test everything. And not because he lacks confidence. He is not permitted to do anything on his own, he is misunderstood and has to feel his way through.

There are many such examples, but there is one conclusion. Concern about the millions of miners and about a comprehensive increase of labor productivity is meaningless right now without a respectful and careful attitude to modern machinery.

It often turns out that identical machinery is delivered to the mine, but it is used differently. Practically half of the completely mechanized cutting faces in our basin have a daily work load of less than 1,000 tons, and nearly a third work under a load of less than 500 tons. It goes without saying that many deficiencies cannot be corrected by the efforts of a brigade, or even of the mine. The associations and the ministry must intervene. Indeed, the development of the existing horizons has sped up with the appearance of powerful mining machinery, but the preparation of new mines and the deepening and reconstruction of the mines are lagging.

Machinery is being delivered late and there is a shortage of spare parts. Transporters are explicitly the weak link in the systems of machines and

mechanisms with which the longwalls are equipped. The scientists and designers have already developed large transporters and they have been certified at Donetsk mines. But the machine builders, unfortunately, are delaying their production.

The Kuzbass has reached a threshold of 150 million tons of production, but last year we took a step not forward, but backward.

We have made our own blunders. At the traditional meeting of the brigade leaders of the leading work forces of mines and cross sections, held recently in the oblast Party committee, we talked about how to put all reserves into action.

The resolutions of the November (1979) Plenum of the CPSU Central Committee and Comrade L. I. Brezhnev's instructions, which he issued at a meeting with brigade leaders of the Baumanskiy electoral district, direct us to the immediate elimination of deficiencies.

Not every one of the legions of miners is putting his shoulder to the wheel, but I honestly, and from my soul, congratulate N. Korotayev's brigade of the "Tyrganskaya" mine, which took 516,000 tons of coal a year from a steeply dipping seam. That is an unprecedented success. It means that there is no limit to the growth of skill and improvement of the organization of labor.

Industrial Processing of Shale--ETU

Tallinn SOVETSKAYA ESTONIA in Russian 12 Feb 80 p 1

[Article by Ye. Ashikhmin: "ETU: The First Kilograms of Fuel Oil Produced"]

[Text] This Sunday morning of 10 February, just as on an ordinary work day, the chief of the new energy technology shop at the Estonian GRES, B. Gamburg, called a meeting of workers of fitting organizations, chiefs and operators. And this meeting ended with the short and long-awaited statement: "We start up today!"

On the main control panel of the energy technology installation there are hundreds of gauges, with which the operator monitors all the "secrets" of the chemical reactions that take place in the heart of the distillation department -- the drum reactor. The gauges monitor not only that section, but also the path of the shale in the feed stock, the temperature and humidity conditions in the drying and dry shale extraction system, and the condition of the active component -- the solid heat transfer agent.

I would like to say a few more words about the latter. The fact is that the problem of industrial shale processing by the solid heat transfer agent process, on which Soviet scientists worked for more than a decade, was solved for the first time in Narva.

The solid heat transfer process, new in the petrochemical industry, was developed by a group of scientists from the shale laboratory of the Moscow Power Engineering Scientific-Research Institute imeni G. M. Krzhizhanovskiy, which is headed by B. Tyagunov.

The construction crews of I. Gugalinskiy and N. Kulikov, furnace liners of P. Golubyye's team from the "Sevenergoizolyatsiya" section, fitters from the brigades of A. Grigor'yev, G. Levchenkov, S. Kuksov and A. Ageyev from the Narva branch of the "Sevzapenergomontazh" trust and many others took part in the realization of the conception of the scientists, designers and planners. Helpers from Moscow, Kiev, Alma-Ata, Rostov-na-Don and many other cities across the country came to the construction site during the hot pre-startup period. Progress on the construction of the ETU, named in "Basic Directions of National Economic Development in the USSR in 1976-1980," was announced regularly in the paper SOVETSKAYA ESTONIYA.

And now, at 2200 hours on 10 December, the chief of the energy technology shop of the Estonian GRES, R. Solov'yev, made the first entry in the watch log: "Steam-gas mixture delivered to condensation department." The steam-gas mixture is converted in the condenser to fuel oil, for the production of which was constructed this gigantic installation with its sophisticated and unique technological equipment, capable of processing 3,000 tons of shale per day. The first production was obtained from the country's first demonstration energy technology plant for converting shale to fuel oil.

The tasks of the builders now are to prepare for operation another ETU unit and to convert the eighth generating unit of the Estonian GRES to fuel oil combustion.

Surgut-Polotsk Oil Pipeline

Moscow SOVETSKAYA ROSSIYA in Russian 6 Feb 80 p 1

[Article by N. Chernavin, Correspondent of the Minneftegazstroy Press Center: "Trail of Courage, the Surgut-Polotsk Oil Pipeline"]

[Text] The Surgut-Polotsk oil pipeline will stretch out over a distance of 3,300 kilometers. Much of this grandiose underground transportation system already exists. Oil from Samotlor, Kholmogorsk, Fedorovskoye and other Western Siberian oil fields is already flowing from Perm' to Gor'kiy.

Minneftegazstroy [Ministry of Oil and Gas Construction] builders have laid more than 2,000 kilometers of 1,220 millimeter and 1,020 millimeter diameter pipes between the Ob' and Volga. They have crossed more than 310 kilometers of swamp, 300 kilometers of water barriers -- rivers, streams and lakes, and have bridged some 100 railroads and highways.

Construction teams of the "Mosgazprovodstroy," "Ryazan'truboprovodstroy," "Kuybyshevtruboprovodstroy," Shchekingazstroy," "Volgogradneftegazstroy"

trusts and other subdivisions of the Ministry of Oil and Gas Industry Construction, extensively engaged in socialist competition in honor of the 110th anniversary of the birth of V. I. Lenin, are accelerating the construction of the oil pipeline.

Green trailers have been set up in a square on the edge of the city of Bor, located 30 kilometers from Gor'kiy. They are the mobile camp of the second construction section of SMU-6 [Construction and installation administration] of "Mosgazprovodstroy" trust. It is quiet. Some are on the pipeline and others sleep in the trailers before going out on shift.

The portable wireless set in the section office, also a trailer, is not quiet. It is talking about gasoline, solar oil and spare parts. A routine day and routine construction problems. The pipeline lives and breathes, and it is gaining strength.

Section chief Vladimir Yegorovich Kalashnikov and senior administration engineer Ivan Kirillovich Badlo study the working map of a section of the pipeline that must be laid by Dotoshno's crew, literally meter by meter. What has been done on that section, what needs to be done, where are the most troublesome places, how to surmount them, how can all construction and fitting operations be sped up? Questions, questions, questions. And every one of them needs a precise, prompt and thoroughly weighed answer. A mistake is an expensive proposition there on the pipeline.

"Our section of the oil pipeline is a short one -- 45 kilometers," says Vladimir Yegorovich. "If it were dry and level we could finish it in a few days. But here on the left we have the Volga flood plain. It is a rough bank. There are five large marshes in our way. Two of them we have crossed, but we have three more, and they are the worst. And there are some small, but just as treacherous marshes, dry river beds and lakes. By and large it is not a right of way, but solid water. And mud. We cannot take a devil may care approach, the high road, but we will get across and push ahead, stepping up the pace every day."

Why did they pick the left bank instead of the well trodden and familiar right bank, where there are already three oil and two gas pipelines? There were several reasons. But the main one was to protect fertile lands. The wide strip on which the pipeline is laid will not be fertile for 3-4 years, even after good recultivation. And there are plans to build not one, but at least three underground systems for transporting oil between Surgut and Polotsk.

They started with the roads. No trace remained of them here after the flood. They dumped gravel, but it became a quagmire under the wheels of the heavy pipe trailers. They poured more gravel, fighting meter by meter. They built foundation beam timber roads with several courses. KrAZ's [Automobile made by the Kremenchug Automobile Plant] and "Urals" ran on them, hauling 36-meter lashes to the pipeline. The first ones on this tough job

were the experienced drivers Viktor Kharitonov and Yulian Ivanov, who graduated from a good school in the construction of the Perm'-Kazan'-Torzhok-Minsk, Yaroslavl'-Moscow and Urengoy-Chelyabinsk pipelines. Every meter along the way posed a danger. They tipped over, skidded and slid the trucks onto the roadside, but the drivers stubbornly forged ahead, where the welders awaited them.

And they, in their turn, showed class. Masters of the art Boris Savel'yev and Vladimir Osipov each welded two and more joints a day with a quota of 1.6 joints. Behind them followed the insulation-laying columns of Viktor Ivanovich Grinchenko and Leonid Grigor'yevich Bronnikov, who covered the pipeline securely with protective polymer film.

Strict quality control was imposed on the welding and insulation. Every seam was checked either with gamma-rays, or by magnetography. Senior radiographer Lidiya Il'inichna Myakotina was worn out, but she was satisfied -- the boys are doing a good job.

They lagged behind kilometer by kilometer. Sometimes, to prevent stopping work, they interrupted the pipeline to bypass a marsh or lake and continued welding and insulating on the other side. But then they had to come back to fix the break. The insulation-laying column had to return to these places four different times. And there are endless curves, about 100 of them in this section, which require special attention and a lot of time and effort.

But, the difficulties notwithstanding, the crew steadily picked up speed. All 45 kilometers of the pipeline section have been welded into a ribbon of steel.

Coal Production in Primorskiy Kray

Moscow EKONOMICHESKAYA GAZETA in Russian No 9, Feb 80 p 7

[Article by A. Volyntsev, Department Chief of the Primorskiy Kraykom of the CPSU, Candidate of Economic Sciences: "Primorskiy Kray -- A Reliable Fuel Base"]

[Text] The rapid economic development of the Primorskiy Kray is accompanied by a steady increase in the demand for fuel and energy resources. In the last decade, for example, consumption in industry has doubled, has increased by a factor of 4.2 in agriculture and 1.8 in the public market.

The main type of fuel in the kray has been and continues to be coal. The principal deliverers of coal are the enterprises of the "Primorskugol'" industrial association, which number 13 shafts and 3 strip mines. They have increased the production of coal from 10 million tons in 1970 to 14.1 million tons in 1979, which is a factor of 1.4. The higher growth rates have been achieved in the last 4 years, and the mean annual increment

is 5.5 percent. About 60 percent of the coal is produced by the economical strip mining method.

The shafts of the association operate mechanized complexes and high-capacity combines, and the strip mines are equipped with new excavators. The use of modern technology and leading experience has made it possible to elevate the energy and mechanical efficiency of mining labor. Labor productivity has nearly doubled in the last decade.

Today the coal industry of the kray is satisfying 90 percent of the demand.

Further acceleration of the development of the industrial forces of the Far East will depend on improvement of the fuel and energy base, and this means principally coal production. There is much to be done. Meanwhile the increment of industrial production outstrips the increment of coal production at local mines. Therefore it will be necessary with each passing year to import more fuel from Siberia, Transbaykal and Yakutiya. Transportation costs are increasing and the railroad is overburdened.

Last year the shortage of coal in Primorskiy Kray was 1.5 million tons. According to calculations, the demand for coal in the kray in the future will increase significantly. Another important circumstance must be taken into consideration. After the industrial reserves of coal are depleted some of the existing shafts and pits will close.

The Prospects Are Good

Under these conditions is it possible first to reduce, and then cease hauling coal in Primorskiy Kray? Yes, the prospects are good. The coal fields are such that we can plan not only to meet the demand of the kray itself, but also to supply some of the demand of Khabarovskiy Kray, Magadanskaya and Kamchatskaya Oblasts with Primorskiy fuel.

Two ways are planned to speed up delivery to the national economy. The first is to accelerate the modernization and reconstruction of existing enterprises with the best geological conditions, and the second is to speed up the construction of new and large coal-producing enterprises, equipped with high-capacity machinery. Preference will be given to the more economical open strip mining, and also to underground mining in shafts where the basic labor processes can be mechanized extensively.

Additional deliveries of nearly 16 million tons of coal may come from new strip mines -- the "Pavlovskiy" No. 2 and No. 3, "Luchegorskiy" No. 2, "Ussuriyskiy" and "Orekhovskiy." Reconstruction of the existing "Tsentral'naya," "Severnaya" and Artem shaft mines will provide an increment of 3.5 million tons. The adoption of scientific-technological progress and scientific organization of labor at other enterprises will increase coal production by another 700,000 tons annually.

The Party kraykom has directed the miners and engineering technicians of the "Primorskugol'" association, builders, scientific organizations and Party committees to the comprehensive solution of the stated problem in order to completely satisfy the local demand for coal as soon as possible. The program of future development of "Primorskugol'" association was examined and approved by the board of USSR Minugleprom [Ministry of the Coal Industry]. Calculations of the association itself and of "Dal'ugle-sbyta" and recommendations of the Vladivostok branch of the Economic Research Institute of the Far East Scientific Center of the USSR Academy of Sciences and of the scientific-technical council of the CPSU kraykom were taken into consideration.

The staffs of the coal mining enterprises exhibit an attitude of great responsibility toward the achievement of the stated goals. Association supervisors are now devoting more attention to the practical adoption of scientific-technical progress and advanced experience. Instead of citing geological problems, they took specific steps to correct deficiencies that are delaying increased fuel production.

Nevertheless the association must work harder. Many mining operations continue to be unmechanized in the mines and pits. Mining equipment and machinery are not being utilized in accordance with established standards. Labor productivity of workers engaged in preparatory and stripping operations is below the coal industry average. There continue to be lagging subdivisions -- industrial sections and mines that are not filling their quotas.

By and large, however, all links of the industry are improving their performance. A huge open pit, the "Luchegorskiy" No. 1, with a capacity of 8 million tons of coal, has been placed in operation and reconstruction of the "Amurskaya" and "Avangard" shafts is complete. Since the beginning of the 5-year plan consumers have received 205,000 tons of coal in excess of the quota. Living conditions are improving, which will promote reinforcement of the cadres.

Radical Measures Are Needed

There are many other problems that will have to be solved. We refer to the need to increase geological prospecting work to find new deposits, suitable for the planning and construction of new mines.

The repair base will have to be strengthened. During the 5-year plan the large excavator and dumptruck pools have doubled, mainline and heavy dump cars have been acquired, and the inventory of auxiliary and road-building machinery has expanded. But our ability to maintain and repair the machinery has not changed much. Right now the two central machine shops can handle only one-fifth of the necessary work load. Centralized maintenance does not yet cover all strip mining machinery -- 132 excavators, 214 heavy trucks and 120 bulldozers. Expansion of the maintenance base

hinges on the construction of a plant for repairing mine transport machinery and a shop for repairing mine shaft machinery.

The association is completing about 60% of construction projects with its own resources -- by the economic method. The maintenance construction subdivisions are directing their efforts at the maintenance of existing facilities and the completion of certain kinds of mining operations.

The miners do have a general contractor -- Glavvladivostokstroy. But an ambitious program of operations is being planned for it, and the main administration does not have the wherewithal to assure the early opening of new coal mines. It has not increased, but rather substantially reduced the volume of capital work on them since the beginning of the 5-year plan. For example, the delivery of "Pavlovskiy" No. 2 strip mine has been delayed for 7 years already.

To spend hundreds of millions of rubles of capital investments in the immediate future the "Primorskugol'" association will establish its own capable and specialized construction organization. The groundwork has already been done -- the "Primorskuglestroy" trust was set up. Additional measures are planned in an effort to improve the effectiveness of construction.

The Planned Program Must Be Completed

In a word, the plans are ambitious. The development of capital construction was subjected to careful technical-economic substantiation. There is no doubt that the planned program is a realistic one. But Primorskiy miners will have to get help from several ministries before they can completely and quickly implement all sections of the plan.

The Party kraykom and the "Primorskugol'" association are counting, in particular, on a positive solution of the problem of adequate financing of geologic prospecting operations in the search for coal by the RSFSR Ministry of Geology. Supplementary annual appropriations of about 2-3 million rubles will be needed. This will enable the Primorskiy territorial geological administration and "Dal'vostuglerazvedka" of the USSR Minugleprom not only to expand the scope of operations, but also to improve their quality and to correct mistakes that were made in the past.

The new "Primorskuglestroy" trust is able right now to complete 16 million rubles worth of construction and fitting operations, and that is not enough. The industrial base of the trust must be expanded. The first thing that must be done is to open brickyards. Glavvladivostokstroy has to complete the construction of the reinforced concrete prop factory in Partizansk. "Primorskugol'" association also needs construction materials for its purposes. And in this respect Glavvladivostokstroy and the Primorskstroymaterialy" association could be very helpful.

The Primorskiy people expect even more help from USSR Minugleprom, which, as we have already said, supports the program of future development of this sector in the kray. Unfortunately, urgent problems related to expanded coal production are being solved slowly. For example, by speeding up the construction of the Artem shaft it would be possible to expand its capacity in a short time by a factor of 2.5, from 1 million to 2.4 million tons. The ministry did not decide on the fate of this shaft, in spite of the appeals of the Party kraykom.

Ways of financing the construction of new mines and the repair base should, in our opinion, be sought more promptly and with greater resolve. Heavy special purpose machinery -- excavators, self-propelled cranes, scrapers, bulldozers and self-propelled graders, must also be provided.

The Far East does not have a special scientific-research or design institute for the coal industry, as other basins of the country have. The association receives little scientific support. The affiliates of the All-Union Scientific-Research Institute of Mine Surveying, of the Oriental Scientific-Research Institute of Carbon Chemistry, Kuzbass Scientific Institute of Coal Research and Kuzbass Scientific-Research Institute of Coal Enrichment are not coordinating their efforts. This impedes the development and adoption of effective means of mechanization and economical mining technology. Our isolation from the leading scientific-research institutes prevents us from more thoroughly analyzing the specific features of mining and geologic conditions of Far Eastern coal fields and of efficient mining techniques. The opening of a branch of the Mining Institute imeni A. A. Skochinskiy would promote the expansion and improvement of scientific support of the kray coal industry.

By developing the coal industry it will be possible to supply all the fuel needs of Primorskiy Kray. There will be certain costs, of course, but they will be paid soon. And then there will be no need to spend a lot of money on long-haul transportation, and it may be possible to develop Far Eastern coal fields even faster.

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WESTERN SIBERIA OIL, GAS POTENTIAL DISCUSSED

Moscow EKONOMICHESKAYA GAZETA in Russian No 11, Mar 80 p 15

[Article by I. Nesterov, corresponding member of the USSR Academy of Sciences, Lenin Prize winner, director of the Western Siberia Scientific Research Geological Prospecting Petroleum Institute, Tyumen': "Oil and Gas Potential of Western Siberia"]

[Text] Hydrocarbons deep in the earth are encountered in the form of a broad gamut of compounds, a number of them being oil, condensate and gas. And although they are quite widely distributed in nature, they are encountered unequally both in individual provinces and in individual deposits. It is economically profitable to concentrate geological research, exploration and prospecting for them in regions of maximum concentration. But for this it is necessary to have in-depth scientific research, making it possible correctly to evaluate the potential of each region. An evaluation made on a low scientific level leads to an incorrect idea of the earth's potential and, ultimately, to an incorrect determination of the volumes of exploratory operations, to reduction of the rates of extracting oil and gas.

At present the calculations of possible levels of preparation of reserves of oil and gas, and determination of the rates and volumes of extracting them from the earth are carried out on the basis of estimates of potential resources with respect to large regions of the country. This trend is a correct one, but it does not give adequate information for planning for the long-term future. Solution of this task is aided by the method of substantiation and isolation of regional exploration targets, which make it possible objectively to evaluate the potential of each region from geological and economic positions.

Stages of Exploration

Meant by a regional exploration target is the bed of rock of a certain geological age existing in a region, lying at various depths, or an area that is not on the surface but in the depths of the earth with a revealed accumulation of oil and gas. Each exploration target differs from another

first of all by the conditions of development and the geological and economic indicators. These targets are singled out with respect to each known or proposed oil and gas containing province of the country in order to determine the time for bringing each one or the complex of them into simultaneous exploration and development.

The rationality of the method of singling out the regional exploration targets is confirmed by the example of evaluating the oil and gas potential of the Western Siberian territorial-production complex. Taking into account the level of study of this region, the status of oil and gas science and the geological prospecting industry, singled out here were 36 regional exploration targets: revealed, proposed and hypothetical. Bringing them into exploration determines the stage of development of the province. In the first stage of study three regional targets were involved: the Minusinskaya depression and the Kuznetsk Basin, the Chelyabinsk basin, and the lower reaches of the Yenisey. As a result, revealed in the Ust'-Yenisey region in 1946 was one large gas development and the priority of concentration of exploration on the Western Siberian plain was demonstrated.

The second stage of exploration included two more targets: the Mesozoic deposits of the Ural region and the Jurassic deposits of the central and southern regions of Western Siberia in the limits of the Tyumenskaya, Tomskaya and Novosibirskaya oblasts. It was capped by the discovery of the Berezovy gas and the Trekhozernyy oil deposits. By the time of their discovery deep drilling was already being done on 5 regional targets. This showed that the oil and gas containing layers here have a complex structure, they are not developed everywhere, and they do not have outstanding significance for the country's national economy. At the same time, the study of them had great theoretical significance, making it possible to prove that it follows to continue oil and gas exploration in a broad front on the Western Siberian plain.

The next stage is the study by drilling two more regional exploration targets: the Cretaceous deposits of the central and southern regions and the Senoman deposits of the north of the plain. In 1961 the Megionskoye and Ust'-Balykskoye oil deposits and in 1962 the Tazovskoye gas deposit were opened in these formations. This immediately brought Western Siberia among the large-scale oil and gas bearing provinces in the world. Later on also revealed in these targets were such deposits as the Samotlor, Fedorov, Mamontov, Salym, and Muravlenkovskoye oil deposits and the Urengoy, Medvezh'ye, Bovanenkovskoye, Zapolyarnoye, and Yamburgskoye gas and oil and gas condensate deposits. Operations with respect to these exploration targets will be conducted in the near future as well.

After discovery of the gas deposits in the Senoman formations, the question arose of the study of deeper formations--the Neocomian. In the first wells aimed at this target, obtained at the Urengoy site were inflows of gas with condensate and oil. Expansion of operations led to the discovery

of new deposits in the Nadym-Purskaya, Pur-Tazovskaya, Yamal'skaya and Ust'-Yeniseyskaya oil and gas bearing oblasts. It has been shown that the Neocomian deposits are the main target for growth in the reserves of condensate.

In total, studied by drilling in Western Siberia by the start of the Tenth Five-Year Plan were 11 regional exploration targets, in 9 of which deposits of oil and gas were discovered. Their intensive development was begun. All this made it possible to confirmon the Western Siberian oil and gas bearing province the title of the country's chief base for oil and gas extraction.

A Second Tyumen'... in Tyumen'

The decisions of the 25th CPSU Congress defined a qualitatively new stage of development of the Western Siberian territorial-production complex. In geology it is characterized by the exposure and prospecting of more complex deposits of oil and gas, by an increase in the depths and volumes of drilling, by the conduct of more detailed studies, an increase in the role of local forecasting, mathematical simulation of geological processes, and by the creation of the foundations of molecular geology.

In addition to those known previously, being brought into exploration are six more regional targets, such as the structural-lithological and lithological deposits of oil and gas, the oil in bituminous clays, deposits of complex structure, paleozoic formations, and others. Scientific validation of their potential will make it possible to declare that the second oil and gas bearing Tyumen' may be discovered... in Tyumen', and Western Siberia will consolidate for itself the role of the country's chief base for extraction of oil and gas.

At the present time industrial oil and gas content has been discovered in 15 out of 17 studied regional exploration targets. But this far from exhausts the potential of Western Siberia. In the future another 14 such targets, the potential of which still has not been determined, may be brought into industrial development. The study of them is a task for the future. Among these new targets are such as the oil and gas content of the Triassic and Paleozoic formations of the north of Tyumenskaya Oblast at depths of more than 5 kilometers, the oil and gas content of low-amplitude traps, zones of regional thinning of Mesozoic sandy rocks and paleozoic carbonates, and others.

If we speak about the still more distant future, it is apparent that even in the new century covered by study will be the resources of hydrocarbons, particularly of gas, which differ sharply from the known formations of oil and gas with respect to their conditions of occurrence and their phase state. These targets are still among the hypothetical, but nevertheless they cannot be denied as sources of hydrocarbon raw material. Among such regional exploration targets are the gases dissolved in ground waters and the solid gas in the form of gas-hydrates.

An increase in the resources of oil and gas is possible not only owing to bringing new targets into exploration. There are great reserves in increasing the coefficient of the oil yield of the earth. Now brought to the surface is approximately half of the reserves of the oil beds. Owing to development of new methods of secondary and tertiary extraction this coefficient can be increased significantly.

An all-round system of evaluation of the resources and development of regional targets, and expansion of the front of scientific and production operations with respect to raising the coefficient of oil yield will make it possible more rationally to plan prospecting, to develop the underground storehouses of oil and gas with smaller labor and material outlays.

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PROGRESS AT EKIBASTUZ FUEL, ENERGY COMPLEX CONTINUES

Moscow STROITEL'NAYA GAZETA in Russian 26 Mar 80 p 2

[Article by our correspondent V. Ovchinnikov: "1. Power of Ekibastuz "]

[Text] In 1977 the decree of the CPSU Central Committee and the USSR Council of Ministers was adopted "On Creating the Ekibastuz Fuel and Energy Complex and Construction of a 1500-kilovolt Direct Current Power Transmission Line Ekibastuz-Center." The calculated period for completion of creation of ETEK [Ekibastuz Fuel and Energy Complex] was 1990. Its construction has become a task of all-union importance.

What is the history of ETEK, what is it today, and what are its achievements, difficulties and problems?

In many Kazakh legends the "inflammable rocks" are mentioned, the wonderful places where the earth ignites from a wood fire... The coal of Ekibastuz has attracted the attention of people for a long time. The first hole, according to legend, was dug here by the Kazakh Kasym Pshenbayev who marked the place with two clumps of salt. The name sort of came from this--Eki-Bastuz--two heads of salt.

The government of the young Soviet republic understood well the importance of these deposits for the economy of the country. The words of V. I. Lenin are famous: "The most important of all the questions is Ekibastuz and its value for the Urals." The Ekibastuz coal was also mentioned in the GOELRO [State Commission for the Electrification of Russia] plan but the country at that time was not capable of coping with and developing the field in northeast Kazakhstan. In 1925 the mines were preserved. In 1940 the war interrupted the restoration work that had been started...

The further chronicle of events in Ekibastuz is as follows. In 1954 the first echelon with Ekibastuz coal was sent to the Urals. In 1965 the output of coal extraction reached 10.5 million T, and by the end of the Ninth Five-Year Plan it approached 50 million tons per year.

The Ekibastuz coal today goes to the thermal electric power plants of the Urals, Kazakhstan and West Siberia. And naturally, with each year more and more of it is needed. What are the supplies of the basin like? The specialists have computed: even if the extraction is increased by several times as compared to today's level, the coal will last more than 100 years. The comparatively shallow occurrence of the bed makes it possible to carry out extraction by the most inexpensive--open-pit method.

However if the extraction is tripled the need for transportation rises the same amount. In order to deliver the coal to the center an additional hundred thousand railroad cars would be required, and this would complicate the operation of the trunk lines. The acuteness of the problem becomes even more understandable if one considers that the ash content of the Ekibastuz coal fluctuates from 35 to 40 and more percent. This means that over one-third of the hauling would be more transporting rock. This is why at the 25th CPSU Congress a basically new decision was adopted: build thermal electric power plants in direct proximity to the Ekibastuz coal basin and thus create a powerful fuel and energy complex (ETEK). Finished electricity will be sent to the consumers on high-voltage transmission lines.

It is planned to bring the extraction of coal at the Ekibastuz open pits by 1990 to 150 million tons per year, and on the whole to 170 million tons. In the region of the city of Ekibastuz a cascade is developing made of four GRES with total output of 16 million kilowatts, and near Lake Balkhash--a plant on 4 million kilowatts. At all 5 plants 220 billion kilowatt-hours of electricity will be generated annually.

An important and integral part of the ETEK plan is the new residences for the builders, power engineers and coal miners with total area over 1,2 million square meters, as well as the Palace of Culture, sports complex, stores, restaurants and many other facilities of social and cultural daily life. It has been calculated that the construction of the ETEK and its subsequent operation will require a growth in the population of the city, that is now over 70,000, by more than triple.

These plans cannot help but be impressive with their scope and the boldness of the scientific and technical solutions. And they are already being realized. Last year the last phase of the world's largest open pit "Bogatyr'" was put into operation. Its rated output is 50 million tons of coal per year. The enormous canyon, consisting solidly of coal, goes downward in steps. Under your feet there is coal, the railroads have been laid on coal, all around there is coal.

The giant machine the height of a 20-story building is a rotary complex that loads the cars in 30 seconds. The output of this aggregate is 5,000 T of coal per hour. There are no such powerful machines anywhere in the world.

And not far from the city the construction of the first of the four GRES is underway. Each of them is eight units with turbines of 500,000 kilowatts each.

Many interesting solutions were used in the planning of the plants. For example, take the problems of ash-removal. The four plants in a year will consume 64 million tons of coal, of which almost half will be converted into ash. What to do with these mountains of wastes? From all four plants on a system of hydraulic ash-removal they will be discharged by self-flow into the drying-up Lake Karasor.

Even more complicated is the problem of supplying the plants with fresh water of which billions of cubic meters per year are needed. There are no rivers close by and all the lakes are saline. Nevertheless precisely the lakes are used. The salt water is pumped out and replaced by clean fresh water from the Irtysh-Karaganda canal. The lake on whose shores GRES-1 is being built has already become fresh.

A lot was planned for the construction of the GRES with such consideration that the modern technology and organization of the construction work would correspond to the high level of the planning solutions.

"The construction of the structural parts for the GRES-1 in modules must be brought to 100%. For example, never before was the underground section of the car-dumper, the block shore pumping stations and much more implemented in the prefabricated variant," relates the manager of the general contracting trust Ekibastuzenergostroy E. Filatov.

Assembly of the equipment is practically being carried out simultaneously with the construction of frames in the room whose wall is moved by bridge cranes as the new sections of the frame are ready. Due to the high level of industrialization and the use of the line method of construction it was envisaged that the GRES would be put into operation in a very short period: starting in 1979 a unit every 6 months, i.e., the outputs will increase by a million kilowatts per year. In order to guarantee such high rates it has been planned from the very beginning to construct a plant where the greatest part of the most complicated work should be fulfilled as possible. This is the so-called rayon production-acquisition base of the Ministry of Power and Electrification (RPKB) rated to serve the construction of all the plants. It must include the structure of assembly organizations equipped with six 50-ton bridge cranes, machine fleet, modern welding aggregates and special equipment for insulation and bricking work. Here all the production equipment is preliminarily assembled and equipped with control and measuring instruments so that the already completely finished units arrive for installation. Other facilities of the RPKB--these are the reinforcement shop for manufacture of reinforced frames, a large base of mechanization, technological lines for repair of the excavation equipment and cranes, and a large auto system.

From the first days of construction the party and government have focused enormous attention on Ekibastuz. The construction site has been declared an all-union shock worker komsomol site, and the Komsomol Central Committee has made a decision to send 4,000 young workers here. Our entire country is

building the Ekibastuz GRES. Having been included in the competition on the principle "Worker Relay Race" the overwhelming majority of contractors are fulfilling their contract commitments with honor.

How is the construction of the unique GRES being implemented? How much have the builders and assemblers been successful in realizing the plan? We will discuss this in the next article.

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DIAMOND DRILL BITS NOT ALWAYS USED EFFECTIVELY

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[Article by M. Aleksandrov, V. Brazhentseva, P. Paliy, Ye. Prusov, L. Dushkina and N. Aplina of VNIIBT [All-Union Scientific-Research Institute for Drilling Equipment]: "Use Diamond Bits Effectively"]

[Text] The industry's use of diamond bits in world practice began in 1946, originally in core drilling, where it enabled higher core recovery. At that time this drilling method began to be developed rapidly. In domestic practice, diamond bits began to be used widely to replace full-hole roller bits in 1961.

Our country has mastered the production of diamond drilling tools for full-hole drilling (code D) and core recovery (code K), for side-tracking ("sidetrack" bits, code DV), for stabilization of the drill-string bottom and for calibration of the wellbore (calibrators, code ST). For the use of diamond tools under various geological operating conditions, bits are being produced for soft rock (type M), rocks of average hardness (type S) and rocks of average hardness with intercalations of the ST and T types of hard rocks.

The introduction of diamond bits has proved to be highly effective under certain conditions, and it has enabled penetration per bit to grow severalfold over roller-type equipment. As a result, the time required for drilling various well intervals has been shortened and monetary and material resources have been saved.

The fact that almost every UBR [drilling administration] has chosen intervals that correspond in physical and mechanical characteristics to the recommendations for using diamond tools has promoted diamond drilling greatly, and a preliminary economic evaluation has been made of operating expenditures during the use of diamond bits in these intervals, considering only those expenditures that bit-operation indicators affect.

The economic desirability of drilling with diamond bits has enabled the amount of drilling with them to increase during a stabilization in the share in total meterage drilled. Thus, for the USSR as a whole, the

annual amount of diamond drilling in 1978 in comparison with 1970 grew 2.4-fold; here its share was 2.2 percent in 1970, and 3.9 percent beginning in 1974, of the total annual drilling volume.

The dynamics of the indicators of operation of bits with real diamonds by Minnefteprom [Ministry of Petroleum Industry] as a whole are shown in table 1.

Table 1

Indicators	1971	1972	1973	1974	1975	1976	1977
Number of bits expended.....	215	187	170	235	176	316	177
Penetration per bit, meters....	262	251	258	204	171	127	163

The reduction in average penetration per diamond bit is explained mainly by the increase in depths at which these bits are being used:

	1970	1977
Number of spent bits as a percent of the total number, in the intervals:		
Up to 3,500 meters.....	70.5	55.1
More than 3,500 meters.....	29.5	44.9

The "displacement" of diamond bits from the upper and middle intervals of wells to great depths is explained by the use here of ISM [Institute of Superhard Materials of the Ukrainian SSR Academy of Sciences] bits. Such "specialization" is justified economically (taking the prices and the indices for using up bits into consideration), and it has been invoked, on the whole, to provide maximum economic effect. In this light, the breakdown of bits as a function of penetration per bit is of interest (table 2).

As can be seen, 53.5 percent of the bits used penetrated more than 200 meters, while only 23.6 percent penetrated less than 100 meters. In 1977, because of a change in depth at which diamond bits began to be used and because of the manufacture of the bits from raw materials of lower quality, this ratio changed, with 46.6 percent of the spent bits penetrating less than 100 meters.

It is pertinent to note that high penetration rates per bit were achieved with a large number of trips of the tools. Thus, in 1970 about 5 trips were made per bit, with an average penetration of 287 meters and a penetration of 58.2 meters per run, while in 1977, with a penetration per bit of 163 meters, about 3 trips were made with a penetration of 56.7 meters per run. Additional trips of the tools were occasioned to some extent by the fact that the drilling equipment had not been prepared for prolonged continuous operation (this relates especially to turbodrills and pumps).

In recent years 12 associations have been performing diamond drilling, the greatest volume being by Komineft' [Oil Production Association of the Komi ASSR], Grozneft' [Oil Production Association of the Georgian SSR] and the

Table 2

Bit characteristics	Year	Penetration per bit: Up to 100 meters — Number of bits	Up to 100 meters — Penetration per bit (m)	Up to 100 meters — Penetration per trip (m)	101-200 meters — Number of bits	101-200 meters — Penetration per bit (m)	101-200 meters — Penetration per trip (m)	More than 200 meters — Number of bits	More than 200 meters — Penetration per bit (m)	More than 200 meters — Penetration per trip (m)
Total.....	1970	37 / 23.6	53	24	36 / 22.9	145	45	84 / 53.5	452	65
	1977	82 / 46.6	49	31	48 / 27.3	148	48	46 / 26.1	398	76
Breakdown by diameter:										
188 mm.....	1970	19 / 29.7	53	24	14 / 21.9	140	46	31 / 48.4	373	58
	1977	9 / 32.1	52	29	11 / 39.3	148	30	8 / 28.6	299	52
212 mm.....	1970	18 / 22.0	52	28	21 / 25.6	150	43	43 / 52.4	496	76
	1977	48 / 52.2	56	35	24 / 26.1	146	60	20 / 21.7	411	91

Note: The numerator shows the number of bits or items, the denominator shows the percent of the total number.

former Kaspmorneft' [Caspian Sea Offshore Oil Production Association]. Their share of the total amount of drilling done with real diamonds was 74 percent.

The bit operating indicators for these associations and for Minnefteprom as a whole in 1977 (in comparison with roller bits) are shown in table 3. The average penetration per diamond bit was 19-fold higher but the mechanical speed was ten-thirteenths that of roller bits used under the same conditions.

Table 3

Association	Diamond bits		Roller bits	
	Penetration per bit, m	Mechanical speed, m/hr	Penetration per bit, m	Mechanical speed, m/hr
Grozneft'.....	89.8	0.78	17.5	1.58
Kaspmorneft'.....	185.6	0.72	8.4	1.00
Komineft'.....	119.8	1.32	4.9	1.47
Ministry of Petroleum Industry as a whole	163.4	0.95	8.5	1.23

At the same time, one cannot help but dwell on the fact that some of the bits were expended with negative results. Fifty-three percent of all "unprofitable" bits had poor penetration (average penetration per bit was 22 meters for 2 runs) because of use in rocks that were not appropriate in physico-mechanical properties. Bits of another group that were spent with good results (more than 100 meters) proved to be unprofitable because they were used in upper well intervals, where the basic (roller) bits were used with comparatively high penetrations per bit and high mechanical drilling speeds. This same group included bits expended at great depths with a substantial number of runs (more than 10).

Thus, the negative benefit of use of diamond bits was the result of the incorrect use of them.

On the average, 13,518 rubles in operational expenditures were saved per diamond bit in 1977, and 266 hours of drilling time were saved.

A further rise in diamond-drilling effectiveness depends upon a rise in the requirements for equipment and technology in the drilling process. In considering the high durability of diamond bits (50-300 hours), the drilling equipment must be carefully prepared for lengthy operation (especially the pump group and turbodrills). Preparation of the bore and the bottom hole (the bottom should be cleared of metal and large cuttings) is acquiring ever-increasing importance. The descent of the tools, the breaking-in of the bottom hole and of the diamond bit, and the drilling itself of the hole must be done strictly in accordance with the instructions for diamond drilling, taking local operating conditions for well penetration into account.

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